

# PATENT SPECIFICATION

888,845

DRAWINGS ATTACHED.

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## COMPLETE SPECIFICATION.

### Improvements in or relating to the Preparation of Wood Pulp.

We, COURTAULDS LIMITED, a British Company, of 16 St. Martin's-le-Grand, in the City of London, England, do hereby declare the invention, for which we pray  
5 that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to the preparation  
10 of wood pulp and is concerned with the drying stage.

In the manufacture of a chemical pulp such as is used in the viscose industry, the wood pulp is usually obtained in sheet form.  
15 In the production of these sheets, non-cellulosic material is removed by chemical processes, for example by the sulphite, sulphate or soda process, and excess of the pulping agent is removed. After further  
20 extraction and purifying processes, the aqueous wood pulp slurry is converted into sheet form and the sheet is dried by passing it through a drying chamber. In the manufacture of viscose, these sheets are there-  
25 after shredded, either before or after the conversion of the cellulose into alkali cellulose.

A disadvantage of this sequence of operations lies in the drying stage, where the pulp  
30 is dried in sheet form. Drying sheets of pulp is a relatively slow operation involving, as a consequence, fairly large machines.

In other industries, such as the paper industry, in which the presence of non-  
35 cellulosic material may not be detrimental to the product, the pulp employed is produced by mechanical means and the chemical pulping is omitted. However, the subse-

quent drying operation is usually still the relatively slow sheet-drying process. 40

To reduce the drying time, we have proposed in Specification No. 809,429 to produce dried wood pulp in a discrete form by fluidising the pulp in hot air supplied under  
45 a fluctuating pressure sufficient to cause the fluidised pulp particles to vibrate.

We have now found that a rapid drying is possible if pulp containing 15 to 75 per cent of liquid, based on the weight of wet pulp, is brought into contact with air which is  
50 initially at a temperature of 300° C. to 550° C., and the air and pulp are subjected to a degree of turbulence sufficient to prevent charring of the pulp, until the air is at a temperature of 90° C. to 120° C. 55

The invention is particularly applicable to the drying of pulp containing 40 to 60 per cent of liquid, in particular 45 to 50 per cent of liquid, which liquid will normally be the water remaining from an earlier  
60 washing stage. The wet pulp may be prepared from a dilute aqueous stock by removing water from the stock by mechanical means, for example using a screw press, a slurry press or a centrifuge. Before drying, 65 the pulp should be in a coarsely lumpy form, for example lumps having a maximum dimension of about 1 to 2 inches. The breaking down, if the pulp is not already in that form, may be effected by using a screw  
70 conveyor. The upper limit of the size of the lumps is, within reasonable practical limits, dictated by the size of the inlet aperture of the machine in which the turbulence is to be produced. 75

While the temperature of the air when it

is originally brought into contact with the pulp may be anywhere within the range 300° C. to 550° C., it is preferably below 515° C. A particularly convenient air temperature drop for wood pulp is from about 500° C. cooling down to about 120° C. The air may be heated by heating devices burning oil, coal or coke or by any other heating means.

10 In order to avoid charring of the pulp during drying, a high degree of turbulence of the pulp and air is desirable, so that the air is cooled from its initial temperature to its lower temperature in a very short time, for  
15 example in less than five seconds or even in a fraction of a second.

In a preferred form of the present invention, the pulp is subjected to a breaking down of particle size while in contact with the hot air, using mechanical means to effect the breaking down. In this way, not only is the "fluffing" resulting from the rapid evaporation of the liquid assisted by the simultaneous reduction in particle size, but  
20 also the high rate of cooling is encouraged by the breaking down.

The conveying of the pulp through the machine in which conditions of turbulence are produced is achieved by the flow of the hot air through the machine. The product  
30 issuing from the machine is therefore a mixture of air with a pulp of low bulk density, for example of the order of 1.5 pounds per cubic foot. The pulp may be  
35 separated from the air by using a cyclone separator, from which the pulp may be conveyed to the equipment for compressing the pulp to bulk densities more appropriate to economical transportation, for example  
40 to bulk densities in the range of 20 to 60 pounds per cubic foot. For this latter purpose, a baling press may be employed, for example.

The exhaust air after separation from the pulp may, if desired, be reheated and recycled to ensure high thermal efficiency of the operation or the sensible and latent heat may be extracted from the air using conventional heat-exchange apparatus.

50 The preferred machine for producing the high degree of turbulence under which the process of this invention is carried out comprises relatively contra-rotating members which intermesh on rotation. Such a machine will now be described by reference to the  
55 accompanying drawing, which illustrates the machine in vertical section.

Referring to the drawing, a shaft 1 carries a rotor 2 and a fan 3, the latter having radial vanes 4. The rotor 2 carries teeth 5 disposed in concentric circles on one of its faces. A further series of teeth 6 projects from the housing 7 of the machine in concentric circles located between the circles of teeth 5.

60 An air inlet passage 8 joins a pulp inlet passage 9 before passing through an inlet aperture 10 into the interior of the drying machine. Communication between the rotor chamber 11 and the fan chamber 12 is provided by an aperture 13. Egress from the fan member is via an exit passage 14.

In operation of the machine, the air at a temperature of 300° C. to 550° C. is introduced via the passage 8, into which it is drawn by the fan 3. The air meets pulp introduced via the passage 9 and carries it through the inlet aperture 10 into the rotor chamber 11. The pulp and air pass out to the radial limits of the chamber and then after passing around the edge of the rotor 2, are drawn between the teeth 5 and 6. Since the rotor is rotating at a rate of about 900 revolutions per minute or even higher, considerable turbulence is produced between the teeth. Simultaneously, the lumps of pulp are broken down by the teeth to a much smaller particle size.

As a result, intimate mixing of the pulp and air is obtained and rapid liquid evaporation takes place. Since the high degree of turbulence effects rapid cooling of the air, the pulp particles are not charred by contact in the dry state with very hot air. The air carries the pulp through the aperture 13 and fan chamber 12 and subsequently passes out of the machine via the exit passage 14 at a temperature in the range 90° C. to 120° C.

Using the machine described above, the five sets of observations set forth in the following examples were made. The examples are given by way of illustration only. The moisture content observations are expressed in every case as a percentage based on the weight of wet pulp. The moisture content was reduced before drying using a slurry press. The air flow is expressed as a volume per minute calculated at 20° C. The pulp flow is based on bone-dry pulp.

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110

		EXAMPLE.				
		1	2	3	4	5
	Moisture content, in per cent, of pulp fed to plant .. ..	94	95	94.5	93	95
5	Moisture content, in per cent, of pulp after pressing .. ..	48	51.5	51	58	45
	Temperature, in °C., of air at dryer inlet .. ..	430	314.5	480	376	498
10	Temperature, in °C., of air at dryer outlet .. ..	115	109	100	106	102
	Air flow through dryer, in cubic feet per minute .. ..	2700	3650	3810	3480	3500
	Pulp flow through dryer, in pounds per hour .. ..	1381	1491	2060	1400	3000
15	Approximate residence time of air in dryer, in seconds .. ..	1½	1	1	1	1
	Moisture content, in per cent, of pulp after drying .. ..	8.5	7.4	6.8	7.2	6.2
20	Heat consumption, in British thermal units, per pound of water evaporated .. ..	1700	1655	1655	1640	1670

#### WHAT WE CLAIM IS:—

1. A process for drying wood pulp, comprising bringing pulp containing 15 to 75 per cent of liquid, based on the weight of wet pulp, into contact with air which is initially at a temperature of 300° C. to 550° C. and subjecting the air and pulp to a degree of turbulence sufficient to prevent charring of the pulp, until the air is at a temperature of 90° C. to 120° C.

2. A process as claimed in Claim 1, in which the pulp contains initially 40 to 60 per cent of liquid.

3. A process as claimed in either of Claims 1 and 2, in which the pulp before being brought into contact with the air is in the form of particles having a maximum dimension not exceeding 2 inches.

4. A process as claimed in any of Claims 1 to 3, in which the air is initially at a temperature below 515° C.

5. A process as claimed in Claim 4, in which the air is initially at a temperature of about 500° C. and finally at a temperature of about 120° C.

6. A process as claimed in any of Claims 1 to 5, in which, while the pulp is in contact with the air, the pulp is subjected to a mechanical breaking down of particle size.

7. A process as claimed in any of Claims 1 to 6, in which the turbulence is produced by means of a machine comprising relatively contra-rotating members which intermesh on rotation.

8. A process for drying wood pulp substantially as described in any of the foregoing examples.

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#### PROVISIONAL SPECIFICATION.

#### Improvements in or relating to the Preparation of Wood Pulp.

We, COURTAULDS LIMITED, a British Company, of 16 St. Martin's-le-Grand, in the City of London, England, do hereby declare this invention to be described in the following statement:—

This invention relates to the preparation of wood pulp.

In the viscose industry the usual form of cellulosic starting material is wood pulp in the form of sheets. In the production of

such sheets, non-cellulosic material is removed by chemical processes, e.g. by the sulphite, sulphate or soda process. After removing the excess pulping agent and further extraction and purifying processes the aqueous wood pulp slurry is usually converted into sheet form by draining sufficient water from the slurry on a wire mesh belt to form a moist self-supporting sheet and then completing the drying by passing the sheet through a drying chamber. In the manufacture of viscose these sheets are shredded either before or after the conversion of the cellulose into alkali cellulose.

It has been proposed in the Specification of our Application No. 29954/56 (Serial No. 809,429) to produce wood pulp in a discrete form suitable for use in the manufacture of viscose by drying a wet pulp slurry, that is pulp containing from 15 to 75 per cent of water, in the form of a fluidised bed formed by hot air supplied under a fluctuating pressure.

We have now found that wood pulp can be prepared from wet pulp slurry by rapidly drying the pulp with hot air under a high degree of turbulence sufficient to convert the pulp into a particulate form.

The wood pulp slurry used in this invention may contain from 15 to 74 per cent, and preferably from 45 to 50 per cent, of water. Thus slurry may be prepared from a dilute aqueous stock by removing water by mechanical means using such equipment as a screw press, a slurry press or a centrifuge. Before drying, the pressed pulp is broken up for example to lumps having a diameter of about 1 to 2 inches.

The preferred machine for achieving the high degree of turbulence desired is one in which the pulp in contact with the drying air, is passed through rotating arms in a direction generally at right angles to their axis of rotation. These arms may be provided with pegs intermeshing with other pegs on static or contra-rotating arms. With a machine of this type the pulp is reduced in particle size while in intimate contact with the hot air so that a rapid rate of drying is assured. With such a machine the hot air entering the dryer may be at 300° to 550° C., cooling down to 90° to 120° C. and a contact time for the pulp for less than 1 second. A particularly convenient temperature range for wood pulp is from about 500° C. cooling to about 120° C. The air may be heated by oil, coal, coke or other heating devices.

The pulp may be separated from the air stream discharged by a normal cyclone, from which the pulp may be conveyed to suitable equipment for compressing it to economical transportation densities. The exhaust air from the cyclone may be re-cycled to ensure a high thermal efficiency or the sensible and latent heat may be extracted in conventional heat-exchange apparatus. The pulp on discharge from the cyclone has a low bulk density and for baling purposes it can be compressed as required, for example using condenser rolls.

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